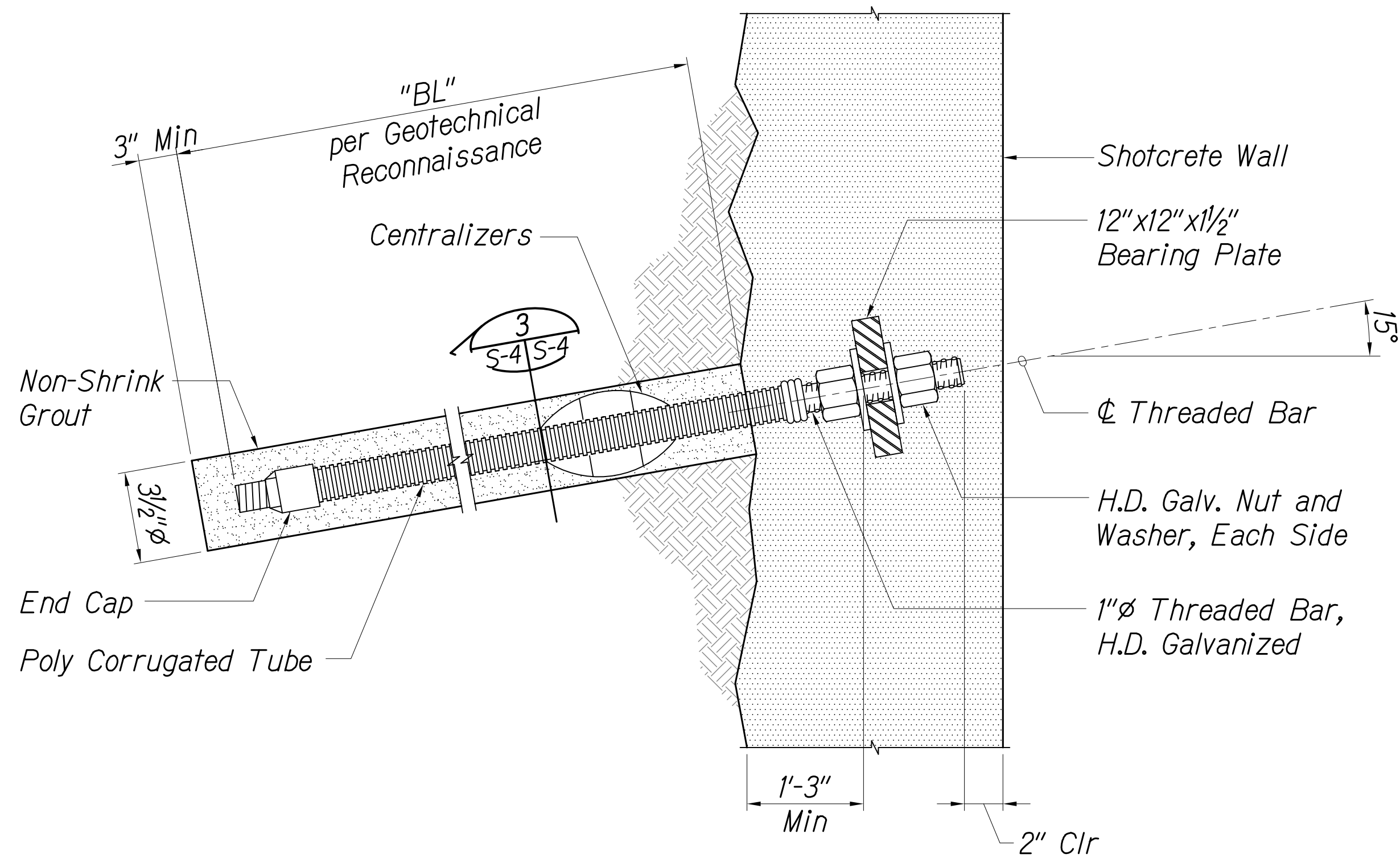
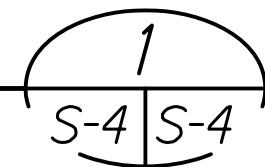


| FED. ROAD DIST. NO. | STATE | FED. AID PROJ. NO. | FISCAL YEAR | SHEET NO. | TOTAL SHEETS |
|---------------------|-------|--------------------|-------------|-----------|--------------|
| HAWAII | HAW. | 36C-01-10 | 2020 | 33 | 35 |



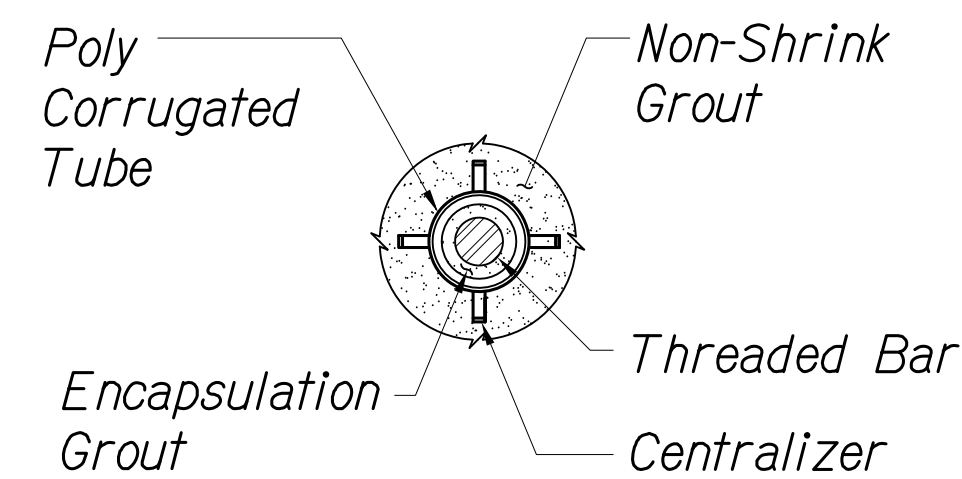
SITE 1 MAKAI SLOPE
HORIZONTAL SOIL NAIL DETAIL

Not to Scale



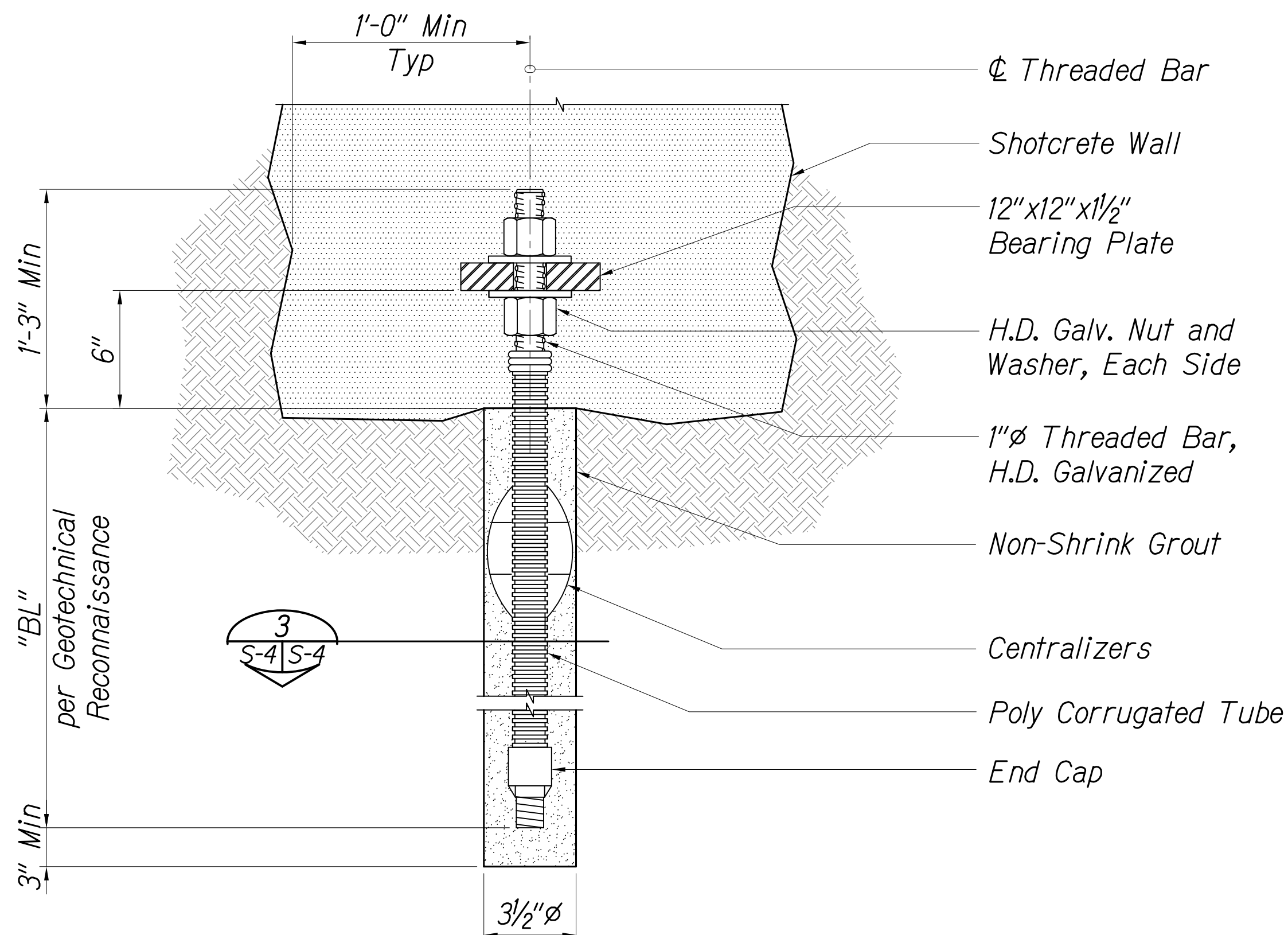
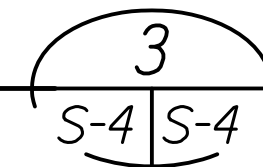
| SOIL NAIL SCHEDULE | | | | |
|--------------------|-------------|--------------|----------------|----------------|
| Soil Nail Type | "A" (in) | "BL" (ft) | "DL" (kips) | "TL" (kips) |
| Horizontal | 1" | 20' | 18 | 36 |
| Vertical | 1" | 15' | 15 | 30 |

Legend:
A = All-thread Bar Diameter (in)
BL = Bond Length (ft)
DL = Design Load (kips)
TL = Test Load (kips)



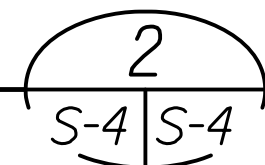
SECTION

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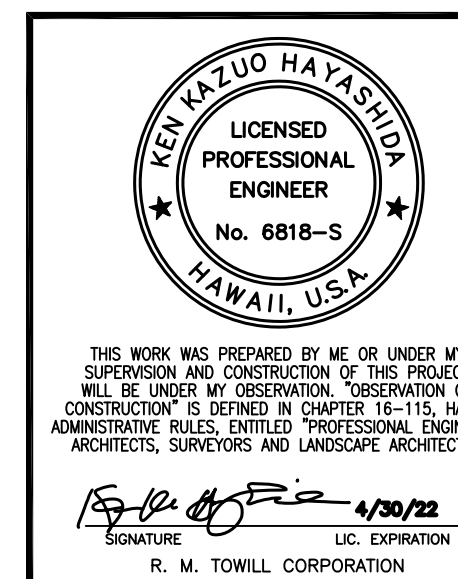


SITE 1 MAKAI SLOPE
VERTICAL SOIL NAIL/ROCK DOWEL DETAIL

Not to Scale



- Site 1 Makai Slope Soil Nail/Rock Dowel Notes:
1. Soil Nail/Rock Dowel threaded bars shall be ASTM A722, Type II, Grade 150 and galvanized per ASTM A153. Yield strength shall not be reduced by more than 5% after galvanizing. If required, bevel washers shall be galvanizing per ASTM A123.
 2. See Soil Nail Schedule on this sheet and Geotechnical Reconnaissance and Evaluation Report for Bond Lengths and Design and Test Loads.
 3. Per the Geotechnical Reconnaissance and Evaluation Report, a soil nail skin friction of 2000 psf was used to determine the horizontal soil nail hole diameter for an allowable pullout capacity of 18 kips with a factor of safety of 2.0.
 4. Per the Geotechnical Reconnaissance and Evaluation Report, the soil nail hole diameter shall be 3/2".
 5. Centralizers shall be placed at 10'-0" max intervals, with the bottom centralizer located 2'-0" from the bottom.
 6. Grout shall be non-shrink Type K and shall have a minimum compressive strength of 4,000 psi in 3 days and 7,000 psi in 28 days.
 7. The grout shall have cured for at least 72 hours and attained the specified 3 day compressive strength prior to stressing. Stressing within 72 hour curing period shall be allowed, provided the Contractor submits compressive strength test results verifying the grout mix has attained the specified 3 day compressive strength in the same curing time tested. Testing for compressive strength shall conform to ASTM C109 mortar and sand.
 8. When lifting the soil nails/rock dowels for installation into the holes, multiple pick points shall be used to avoid bending or damaging the threaded bars and/or encapsulation grout.
 9. Soil nail/rock dowel threaded bars shall be new and free of any surface damage, kinks, and sharp bends.
 10. A Civil Engineer, licensed in the State of Hawaii and who specializes in Geotechnical Engineering, shall be present to monitor the installation and testing of the soil nails/rock dowels. Contractor shall coordinate the installation and testing schedule with the State's Project Engineer. Contractor is responsible for paying for Geotechnical services and for testing services.
 11. Pullout proof tests should be performed on 10% of the installed soil nails/rock dowels (3 horizontal soil nails and 2 vertical rock dowels) in accordance with ASTM D3689. See special provision 512 for details.
 12. Soil nail/rock dowels shall conform to special provision 512.



STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION

**SITE 1 MAKAI SLOPE
SOIL NAIL DETAILS**

HANA HIGHWAY ROCKFALL
MITIGATION MP12
PROJECT NO. 36C-01-10

Scale: MARCH 2020

SHEET No. S-4 OF 35 SHEETS